chaaf & Wheeler
CONSULTING CIVIL ENGINEERS

100 N. Winchester Blvd., Suite 200
Santa Clara, CA 95050
(408) 246-4848
FAX (408) 246-5624
s&w@swsv.com

TECHNICAL MEMORANDUM

DATE: August 2, 2004 JOB NO: CYHG.01.03-003

SUBJECT: **HYDROLOGIC ANALYSES FOR CVSP COMPOSITE CORE PLAN**

PURPOSE

This technical memorandum examines hydrologic impacts of the Coyote Valley Specific Plan Composite Core Plan, which is the so-called "armature" plan as the recommended comprehensive design alternative for Coyote Valley. Schaaf & Wheeler has analyzed valley hydrology in the context of several evaluation criteria:

a) Technical feasibility
b) Regulatory feasibility
c) Ecological sustainability
d) Value added
e) Inertia (getting started)
f) Growth over time
g) Risk
h) Social equity
i) Regional contribution
j) Council Vision and Expected Outcomes
k) Traffic impacts within and surrounding Coyote Valley
l) Healthy lifestyle
m) Walkability
n) Equitable spread of costs and benefits

Many of the evaluation criteria are hydrologically "neutral" as identified in this TM.

In addition to the Composite Core Plan, two additional environmental footprint concepts are evaluated and compared to the Core Plan. The intent of the evaluation is to provide feedback to the land planning process in advance of more detailed planning and design work.

SUMMARY OF FINDINGS

Several preliminary conclusions can be reached based on hydrologic analyses of proposed land use plans and environmental footprints for Coyote Valley:

1) A restored Fisher Creek riparian corridor (approximately 300 feet in average total width) and multi-purpose lake (minimum 60 surface acres) through the Coyote Valley Urban Reserve preserve sufficient flood storage in mid-Coyote to mitigate increased 100-year peak runoff into Coyote Creek.

2) Without the lake to provide urban detention during extreme runoff events, the relocation of Fisher Creek as shown in the core armature plan is not sufficient to fully mitigate increased runoff to Coyote Creek. Additional floodplain storage would be required.

3) It is not necessary to divert Fisher Creek into the proposed lake to achieve peak runoff mitigation. In fact, diversions of Fisher Creek discharge tend to overwhelm the lake as presently envisioned leading to large potential fluctuations in winter water levels.

4) Flood protection facilities approved for North Coyote are sufficient to service the core land use plan as presently envisioned.

5) If disturbance to the existing Fisher Creek conveyance through mid-Coyote is avoided, a bypass floodway roughly equivalent in size to the proposed relocation of Fisher Creek is still required; and that bypass would logically follow the footprint of the relocated creek through the areas of lowest relief south of Bailey Avenue.

6) Because the current Fisher Creek alignment would receive low flows, it would be difficult to maintain certain habitats in any flood bypass.

7) The flood attenuation function of a focal lake could be dispersed to multiple small lakes, but the sum total area of those lakes is likely to be larger than for a single centralized lake.

8) The focal lake shown in the core plan should be isolated from the groundwater table.

9) Variations in environmental footprints for drainage and flow conveyance should have neutral impacts on groundwater resources in Coyote Valley.

10) The selection of one of the basic three environmental footprints or variations thereof, will not have a significant impact in terms of meeting Council's vision and expected outcomes.

ENVIRONMENTAL FOOTPRINTS

Coyote Valley is part of the Santa Clara Valley that lies between the eastern flank of the Santa Cruz Mountains and the west side of the Diablo Range. The valley is part of Coyote Creek's watershed, which is the largest watershed (over 320 square miles) within Santa Clara County. After leaving Coyote Valley through the Narrows, Coyote Creek traverses San Jose and Milpitas on its way to San Francisco Bay.

Coyote Valley is the smallest of three valleys between the Diablo Range to the east and Santa Cruz Mountains to the west. (An oblique view of the valley is provided below.)

Coyote Valley from Tulare Hill Looking South

Coyote Creek is known as a "perched" creek, one that is set above its natural floodplain. Formed by alluvial action over geologic time, water spilling out of the stream will flow away from it, and in this case down gradient to the north and west toward Fisher Creek which more closely hugs lower areas adjacent to the Santa Teresa Hills. A railroad berm and concrete median barrier that transects the valley from north to south adjacent to Monterey Highway tends to prevent spill from Coyote Creek from entering Fisher Creek.

Most of the CVSP lies within the Fisher Creek watershed, which drains 16 square miles of undeveloped uplands and agricultural valley floor to the Coyote Narrows. By comparison, only a relatively small portion of the valley east of Monterey Highway drains directly to Coyote Creek. At its confluence with Fisher Creek, Coyote Creek and its eastern tributaries drain approximately 205 square miles. Discharge in Coyote Creek downstream of the Narrows is therefore dominated by discharge in Coyote Creek upstream of the Narrows rather than Fisher Creek. Anderson Reservoir provides water supply storage and incidental flood control storage for Coyote Creek south (upstream) of the specific plan area. Flood flow releases are uncontrolled.

Creek Characteristics

As it flows through the study area, Coyote Creek is an incised natural channel perched above its westerly floodplain. Sands and gravels predominate along its bed, and several man-made quarries have somewhat altered its natural flow regimes. Historically, Coyote Creek has meandered throughout its valley. In its present form, the creek is able to contain the majority of its discharge, even under estimated 100-year (one percent) flooding conditions. By comparing creek cross sections taken under existing conditions to those taken in the late 1970s, it appears that the creek has shifted a bit in places and may have enlarged itself during the flood events in intervening years. The SCVWD does not list this reach of Coyote Creek as one prone to streambed degradation or aggradation.

The Fisher Creek channel is a manmade earthen channel within the Urban Reserve and North Coyote Valley areas, improved by a reclamation project in about 1963, and generally privately owned and maintained for agricultural drainage. The channel reach from Monterey Highway upstream to Bailey Avenue was constructed as a reclamation ditch to drain the low-lying area known as Laguna Seca. The existing channel is generally shallow and includes low levees. Most of the channel upstream of Santa Teresa Boulevard is located east of the lowest areas of the valley. Smaller drainage ditches west of the Fisher Creek channel collect agricultural and hillside runoff and discharge to Fisher Creek, which also drains the area east to the Union Pacific Railroad (UPRR). North of Bailey Avenue the channel has capacity for approximately the 10-year flood; south of Bailey Avenue existing channel capacity is for the 5-year flood, or less.

As discussed in Chapter 2, low lying areas north of Bailey Avenue are subject to periodic inundation during wetter years. Clay deposits relatively close to the ground surface create a perched groundwater table and prevent deep percolation of surface runoff. The Laguna Seca area adjacent to the southwest quadrant of Tulare Hill is particularly susceptible to ponding.

Laguna Seca in North Coyote Valley

In 1982 the Federal Emergency Management Agency (FEMA) produced a set of maps that identify flood hazards within Coyote Valley. This Flood Insurance Rate Map (FIRM) remains the official effective document governing the National Flood Insurance Program (NFIP) as it is applied within the valley in both the City of San Jose and unincorporated Santa Clara County; and has land development implications for areas in both the Fisher Creek and Coyote Creek floodplains.

Methodology

To focus on an evaluation of alternative footprints and various feasibility criteria, simplified numerical methodologies have been employed. Land use typologies provided by the Dahlin Group have been converted to GIS format to estimate land cover (percent impervious) and superimposed over the rainfall-runoff model used to prepare the Conditional Letter of Map Revision for the Coyote Valley Research Park. Unit hydrograph techniques from the *Santa Clara County Drainage Manual* (Schaaf & Wheeler, 2004) are used to estimate 10- and 100-year runoff after proposed development for comparison to pre-development runoff at the Confluence of Fisher and Coyote Creek.

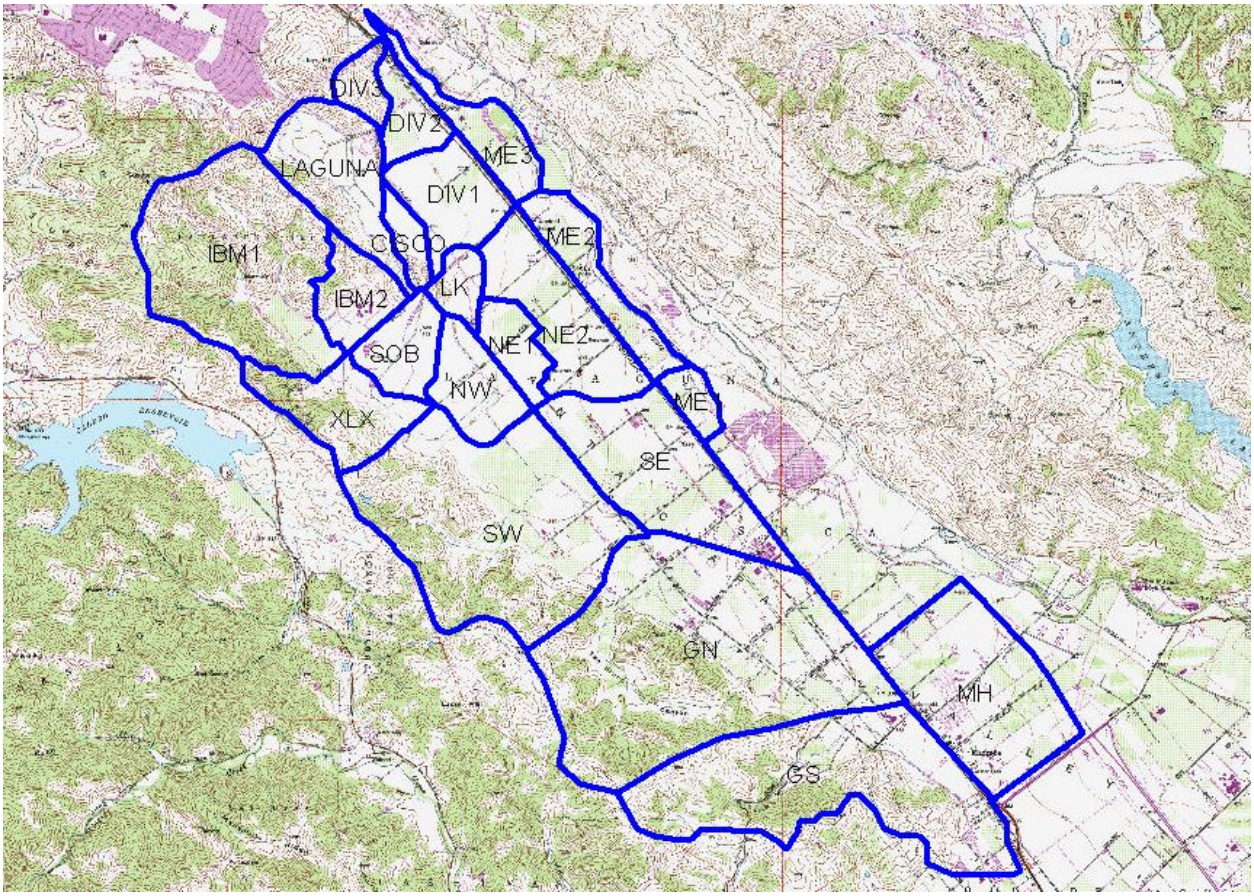
Incorporation of Best Management Practices that minimize directly connected impervious areas (e.g. bioswales and other surface treatment systems in lieu of hard piped outfalls to receiving

waters) are modeled by using a lumped parameter for percent impervious (hardscape) cover over permeable soils. Uniform infiltration rates are taken directly from the CVRP CLOMR model.

The environmental footprint in Coyote Valley must serve to preserve floodplain storage and prevent increases in downstream discharges or impacts.

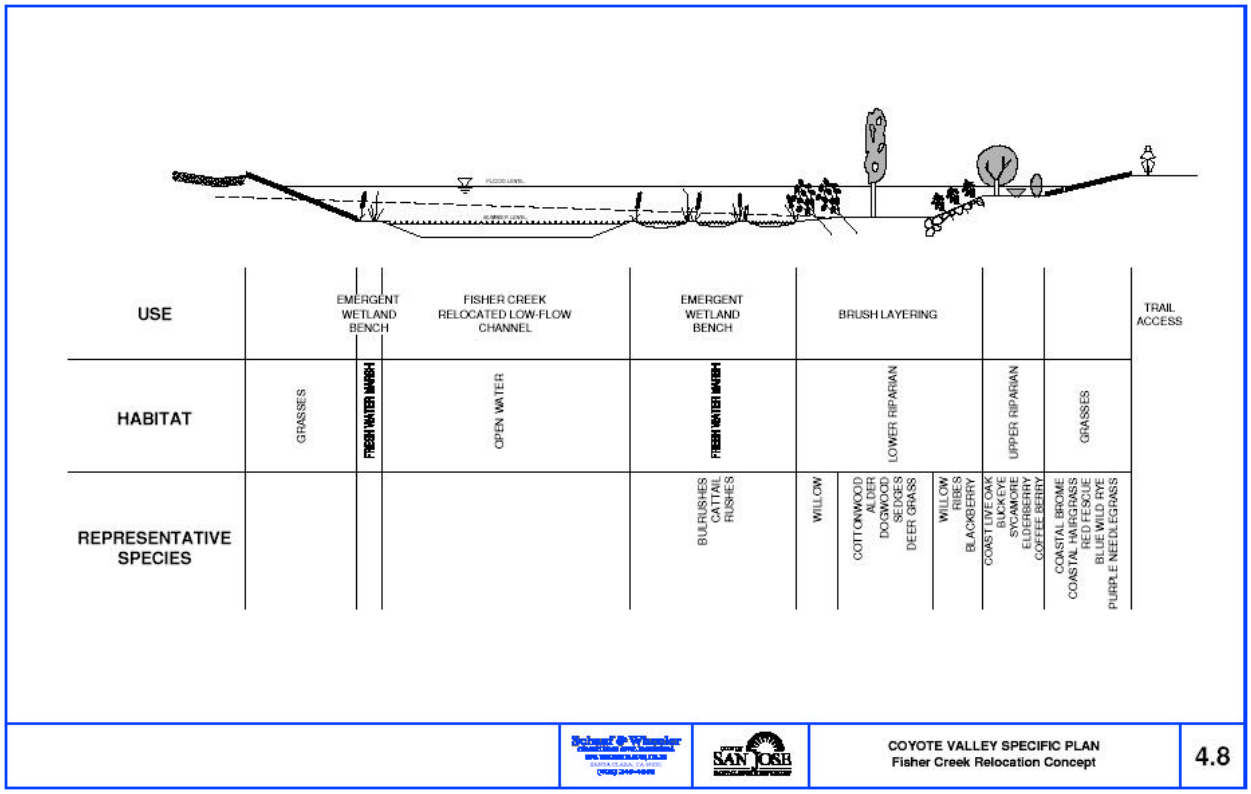
FISHER CREEK WATERSHED

The core armature plan's environmental footprint moves water through the valley in its natural (pre-existing) course. The drainage basin map shown below details the subdivision of tributary drainage areas used for analysis.



Tributary drainage areas used for hydrologic analyses

The current Fisher Creek would be abandoned from Richmond Avenue to Bailey Avenue. South of Richmond, a riparian corridor would be restored along the creek, and this corridor would be continued through the lowlands between Richmond and Bailey in the creek's historic course. The corridor would average roughly 300 feet in total width, varied for interest, with about 30 feet left open and maintained for flood flow conveyance. Based on planned facilities north of Bailey Avenue, the channel would be between 8 and 10 feet deep to the low-flow channel. In concept, the riparian corridor would look something like this:



Flood flows are conveyed through the open water portion of the corridor, which is maintained, while the riparian areas provide flood storage to help reduce downstream flows. A series of control structures (e.g. culverts) at road crossings are sized to back water up into the riparian areas, which are ineffective for flow conveyance.

When this concept is modeled using the 300-foot corridor from the core plan, 100-year Fisher Creek discharge at Coyote Creek (2,200 cfs) exceeds existing conditions discharge (1,890 cfs). Either this riparian corridor needs to be enlarged, or an additional storage facility provided.

Focal Lake

The focal lake provides the necessary means for further reductions in post-urban runoff. A preliminary lake concept with about 60 acres of surface area, a vertical bulkhead at the normal pool elevation, and 5:1 maximum side slopes away from the lake has been modeled.

In the most optimum drainage configuration, urban areas in the Northeast District would drain to the lake rather than Fisher Creek, discharging urban runoff across an environmental edge for pollutant filtration. Under this scenario, the predicted results listed in Table 1 are achieved. "Constraint" refers either to an existing condition that must be matched, or a design constraint imposed by previously approved facilities in North Coyote.

Table 1: Core Plan Model Conditions on Fisher Creek

Condition	Discharge or Stage	
	Constraint	Proposed
Bailey Avenue Discharge	2,975 cfs	2,910 cfs
Laguna Seca Storage Elevation	250 feet ±	250.1 feet
Discharge to Coyote Creek	1,890 cfs	1,835 cfs
Focal Lake Surcharge		4.1 feet

At a 5:1 edge slope, a four foot surcharge means a band of maximum winter ponding outside the normal lake surface of 20 feet. Further iterations based on different lake edge treatments are recommended if this is an unacceptable solution. (It should also be pointed out that more detailed analysis will be necessary once a firmer lake grading plan is available.) To decrease this surcharge, additional storage throughout the valley is required or the lake needs to be larger.

Some thought and analysis was given to allowing overflow from Fisher Creek into the focal lake. Regulatory hurdles may abound, but more practically; any substantial flood overflow from the creek into the lake overwhelms it in its present configuration and leads to untenable surcharges. (In one case with less reserved floodplain storage, 27 feet of lake surcharge was predicted.)

Winter surcharge can be accommodated within surrounding park uses, but there will be maintenance issues in terms of damaged landscaping, mud and silt removal, and a discontinuity of use. Public safety in the face of unpredictable weather is also an issue with joint use facilities such as this. Not allowing Fisher Creek flows into the lake may help ameliorate water quality issues during surcharge periods. Ten-year surcharge is predicted to be two feet with the core plan facility.

The focal lake has been modeled with a 48-inch diameter morning glory spillway set at the midpoint of the vertical bulkhead, discharging to Fisher Creek. An emergency spillway (weir) will also be provided in the event of normal spillway blockage or other problem. (The model shows no spill over the emergency release during a one-percent event.) The “safety valve” for flood releases should be downstream to the Fisher Creek Bypass, not into the focal lake.

Model scenarios have also been run allowing the Southeastern District to drain to the lake through the conceptual urban canal. However, the lake would need to be larger to absorb the additional runoff without excessive surcharge (up to ten feet). It is therefore proposed to drain this area to the urban canal at Santa Teresa Boulevard, but then back to Fisher Creek rather than to the lake.

Keeping the Fisher Creek Alignment

The path of least resistance from a regulatory perspective is to leave the Fisher Creek alignment alone. However, it is woefully inadequate to convey either natural or urban runoff through the valley. A flood bypass similar to the riparian corridor is still necessary to convey flood flows to waiting facilities at Bailey Avenue. Without a supply of low-flows, riparian habitats may be difficult to establish in this bypass. Recreational uses and other types of linear parks would, however, be compatible with the flood protection function.

Smaller Lakes

Smaller, dispersed lakes, seasonal wetlands and other dry detention facilities could be used to perform the flood flow attenuation function of the focal lake. Without examining a myriad of possibilities quantitatively, experience suggests that while such an alternative concept is feasible; often the sum total area of the dispersed lakes might exceed the total attenuation volume of the centralized focal lake due to issues in hydrograph timing and so forth. Further analysis would be required if such an alternative were to be considered.

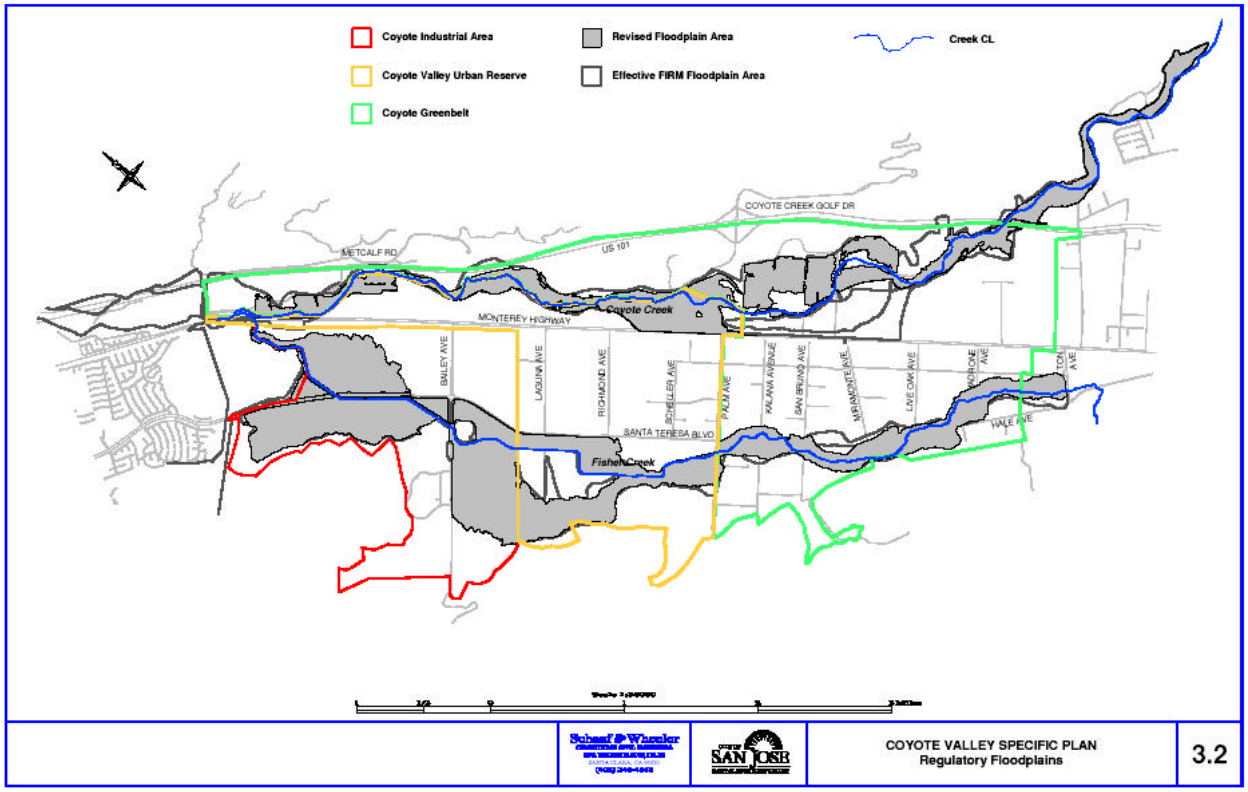
COYOTE CREEK WATERSHED

As indicated by Table 2, proposed development east of Monterey Highway has less than a 0.1 percent impact on discharge at the confluence. The larger issue is the plan for development within Coyote Creek's natural overbank floodplain.

Table 2: Hydrologic Impacts of Urbanization East of Monterey Highway

Location	**Existing 100-year Discharge** (cfs)	**Developed 100-year Discharge** (cfs)
Downstream Anderson Reservoir	12,615	12,615
Upstream Fisher Creek Confluence	12,803	12,811
Downstream Fisher Creek Confluence	13,495	13,502

It is also noted that the District's design discharges for Coyote Creek differ by about 15 percent from the published FIS, in which the 100-year discharge for this reach of Coyote Creek is 15,000 cfs. This difference may be due to differences in antecedent storage assumptions and design rainfall; and is significant because a 1,300 cfs spill across from Palm Avenue causes the overbank flooding:



This issue needs to be resolved in one of two ways:

1) Allow for the flow of roughly 1,300 cfs through the development by providing channel or street conveyance. Particular attention would be paid to the looping reconfiguration of Monterey Highway, which could block flow.

2) Place fill in the area to lift development above the floodplain. Since this is a perched creek, fill may be placed without affecting Coyote Creek between the natural banks and previously spilled flow would remain in the channel. With 15,000 cfs design discharge the maximum increase in Coyote Creek's water surface in reaction to the fill is about 0.8 foot. This will be a regulatory issue, although it appears that no significant damage to surrounding properties results. With a design discharge of 12,800 cfs (per SCVWD) this is not an issue.

Eventually, a far more detailed analysis of the Coyote Creek floodplain is required, including an update of current channel vegetation and roughness.

COYOTE VALLEY GROUNDWATER BASIN

The choice of an environmental footprint potentially affects the groundwater basin by altering patterns of groundwater recharge and discharge through Fisher Creek. The focal lake presents an additional opportunity for direct groundwater recharge or discharge.

Assuming that the depths of alternative channel and bypass alignments are roughly equivalent, the choice of an alternative is hydrologically neutral in its impact on the groundwater resource. A focal lake is likely to be lined and hydraulically disconnected from the groundwater, so its impact on the basin is limited as well.

EVALUATION CRITERIA

In summary, an environmental footprint analyses from the perspective of hydrology impacts the filtering criteria as such:

a) Technical feasibility – each of the alternative footprints is technically feasible in concept, but without the focal lake, additional storage must be built into the plan.

b) Regulatory feasibility – while implementation of the core plan will take additional regulatory effort relative to an avoidance concept for Fisher Creek, that effort should pay rewards in terms of a more natural and sustainable system.

c) Ecological sustainability – The core plan footprint is the most sustainable plan for Fisher Creek since it flows with rather than fights nature. The focal lake adds sustainability issues to the equation.

d) Value added – the core plan adds a focal point to the development and valuable riparian habitat. Other plans have similar values to the community although the core plan appears to be the most appealing. Hydrologically, the core plan functions the best.

e) Inertia (getting started) – the proposed environmental footprint will likely start and define the development.

f) Growth over time – Flood protection facilities are needed immediately. Phased growth is not an option. Drainage systems can grow over time to connect into waiting downstream facilities.

g) Risk – Each flood protection alternative would be designed to meet national standards, which allow a one percent annual chance for exceedence. Nothing is risk-free.

h) Social equity – not applicable

i) Regional contribution – preservation of flood storage to attenuate downstream releases.

j) Council Vision and Expected Outcomes – Drainage and flood protection are not specifically addressed in this document, but the environmental footprint is compatible with "a rich system of parks, trails, and recreation areas."

k) Traffic impacts within and surrounding Coyote Valley – hydrologically neutral.

l) Healthy lifestyle – Protection from floodwaters and nuisance waters (both flowing and standing) is essential to a healthy lifestyle. Best management practices eliminating buried drainage system should be evaluated very carefully, particularly with the appearance of the West Nile Virus in Santa Clara County.

m) Walkability – hydrologically neutral.

n) Equitable spread of costs and benefits – assumed for each alternative footprint.